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AUTHOR Gibson, Joan M.
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ABSTRACT

This study investigated the developmental patterns for 82 deaf individuals (9-19 years old) in field dependence, as measured by the Embedded Figures Test. A significant sex difference was found for these deaf subjects only at the age of 15, favoring males. The deaf subjects differed significantly from the hearing norm group only at ages 15 and 17. There was no significant relationship between field dependence and either age-at-onset of hearing loss or degree of loss, given the limited range of variables tested. A significant relationship existed for both females and males between reading and language, and field dependence. When age and IQ were added in a stepwise regression analysis, only reading remained significant for females. (Author/CL)

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FIELD DEPENDENCE OF LEAF STUDENTS: IMPLICATIONS FOR EDUCATION

Joan M. Gibson
State University of New York at Buffalo

Abstract

This study investigated the developmental pattern for deaf individuals in field dependence, as measured by the Embedded Figures Test (1971).*

A significant sex difference was found for these deaf subjects only at the age of 15, favoring males. The deaf subjects differed significantly from the hearing norm group only at ages 15 and 17. There was no significant relationship between field dependence and either age-at-onset of hearing loss or degree of loss, given the limited range of variables tested. A significant relationship existed for both females and males between reading and language, and field dependence. When age and IQ were added in a stepwise regression analysis, only reading remained significant for females.

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* A separate study was also done on the relationship between field dependence and certain socio-emotional characteristics of the deaf.

Significance of the Study

Field-dependence-independence is an important dimension of cognition, distinguishable from intelligence and verbal abilities, which has implications for personality, child development, and pathology, as well as for thinking and learning. This study investigates the field-dependence-independence of the deaf. Using field dependence as a variable with the deaf may help provide answers to persistently unanswered questions in the area of psychology and education. Does sensory deprivation, such as deafness, influence cognitive and personal development? What is the role of language and communication on cognitive development?

Statement of the Problem

The purpose of this study was to examine the pattern of field dependence among the deaf, by age, sex, age-at-onset and degree of loss; and by investigating the relationship between degree of differentiation as reflected in field dependence and certain language measures in deaf persons.

Research Hypotheses

(1) Is there a relationship between field dependence and measures of age and categories of sex in deaf persons?

It was hypothesized that there will be a sex difference, for ages 10 through 19, with males being more field-independent than females, and that field-independence will increase with age, but not to the extent found with normal hearing persons.

(2) Is there a relationship between field dependence and measures of age-at-onset and degree of loss in deaf persons?

It was hypothesized that field-independence will increase as a function of delayed onset, and that field-independence will decrease with greater degree of loss.

(3) Is there a relationship between field dependence and measures of verbal ability, such as the Reading subtest from the California Achievement Test?

It was hypothesized that for deaf persons field-independence will be positively related to verbal ability measures.

Definition of Terms

The perceptual component of the larger cognitive dimension of differentiation is termed field dependence. Psychological differentiation, as proposed by Witkin (1962), serves as a construct for conceptualizing one's degree of articulation of experience of the world, of the self, and in intellectual functioning. The construct of the field dependence is often referred to as the field-dependence-independence dimension involving field-dependence at one end of the continuum and field-independence at the other end.

Field-dependence: A cognitive style which describes the tendency to give greater credit to external referents in a self-consistent way; a person with a field-dependent way of perceiving tends to experience his surroundings in a relatively global fashion, passively conforming to the influence of the prevailing field or context.

Field-Independence: A cognitive style which describes the tendency to rely primarily on internal referents in a self-consistent way; a person with a field-independent way of perceiving tends to experience his surrounding analytically, with objects experienced as discrete from their backgrounds.

Subjects

The subjects were selected from St. Mary's School for the Deaf, Buffalo, New York. St. Mary's is a private, state supported school for deaf students. The school includes prenursery through senior high departments, serving 214 children

educationally handicapped by deafness. St. Mary's provides a total educational program for deaf children using a Total Communication approach.

St. Mary's serves severely handicapped deaf students from a wide geographic area, with residential students (1980-1981) comprising 28 percent of the total school population.

The sample chosen for this study was not representative of the St. Mary's population as the result of excluding certain multihandicapped students from the selected group. Since the Embedded Figures Test is a timed visual perception test, any handicapping condition which would bias these test results was eliminated. The following handicapping conditions were screened out: legally blind, partially sighted, perceptual motor disorders, learning disability with low functioning life skills, educable mentally retarded, and some upper-body orthopedic disabilities.

Table 1 contains a comparison of student populations from the Annual Survey by the Office of Demographic Studies, Washington, DC.

Table 1

Percentage of Students with Certain Demographic Characteristics

Demographic Characteristics	Student Population			
	National[a] (15,990)[b]	St. Mary's (236)	Sample (82)	
Day students	27	75	74	(61)
Resident students	73	25	26	(21)
	Onset and Cause			
Congenital	69	70	78	(64)
Hereditary	13	12	4	(3)
	Degree of Loss			
Moderate (41-55 dB)	1.4	0.9	0	(0)
Moderately severe (56-70)	6	3	1	(1)
Severe (71-90)	23	16	12	(10)
Profound (91 --)	66	81	87	(71)

Table 1 - continued

Demographic Characteristics	Student Population: National[a] (15,990)[b]	St. Mary's (236)	Sample (82)	
	Additional Handicapping Condition			
Learning disability	4	10	16	(13)
None	73	48	67	(55)
One	19	29	29	(24)
Two	6	16	5	(4)
Three	2	7	0	(0)

[a] Source: Office of Demographic Studies, Gallaudet College, Washington, DC. Annual Survey 1979-1980.

[b] Numbers in parenthesis indicate number of students.

A further description of the sample is given in Table 2. Means and standard deviations of descriptive data are listed; sample size by age and sex is given.

Table 2

Sample Description

Age	Sex: Male[a]	Female[b]
9	2	5
10	7	3
11	5	3
12	1	2
13	4	4
14	2	6
15	0	3
16	8	5
17	6	3
18	2	6
19	2	3

Descriptive Data	Mean	Standard Deviation
Degree of loss (dB)	102.38	10.40
Age-at-onset (months)	4.39	12.21
Nonverbal IQ: Males	104.33	14.07
Nonverbal IQ: Females	98.05	22.19

[a] $n = 39$. [b] $n = 43$.

Instruments

The Embedded Figures Test and a personal data form were used to gather data for the investigation of the concept of field dependence as it relates to certain demographic variables of these eighty-two deaf subjects.

Embedded Figures Test (EFT). This test was devised by H. A. Witkin (1950) for ages 10 and over as a measure of field dependence. A score on the EFT is the man time in seconds for the completion of the disembedding task. A high score is indicative of a field-dependent perceptual style; a low score is indicative of a field-independent style. The original EFT is composed of 24 complex figures and 8 simple figures; each of the simple figures is embedded in several different complex figures. Two shortened forms of the EFT were devised by Jackson (1956) and revised by Witkin. Form A (first 12 figures of original 24) was used for the present study.

Personal Data Form. A personal data form was designed to obtain specific information from the school files concerning the subject's age, sex, race, dB loss of each ear, age-at-onset (measured in months), hearing status of parents and siblings, other handicapping conditions, probable cause of deafness, performance IQ, and scores on the reading and language subtest sections of the California Achievement Test (CAT).

Summary of Results

Hypothesis 1. There is a significant relationship between field dependence and sex only at age 15, given the small n at each age group. EFT performance exhibits a moderately linear and significant relationship with age for males, age accounted for 23 percent of the variance. The relationship for females is curvilinear. Males, especially, exhibit an age-regressive pattern in adolescence. There is a strong but not significant interactive effect of age and sex in EFT

performance, females being more field-independent at ages 10, 11, and 12; males are more field-independent at ages 13, 15 and 17.

Hypothesis 2. There is not a significant relationship between degree of loss and field dependence. There was not a significant relationship between age of onset and field dependence, given the limited range tested.

Hypothesis 3. There is a significant relationship between field dependence and verbal ability when measured by the CAT Reading and Language subtests. When both age and IQ are controlled, only the Reading subtest remains a significant predictor of field dependence for females.

Results and Discussion

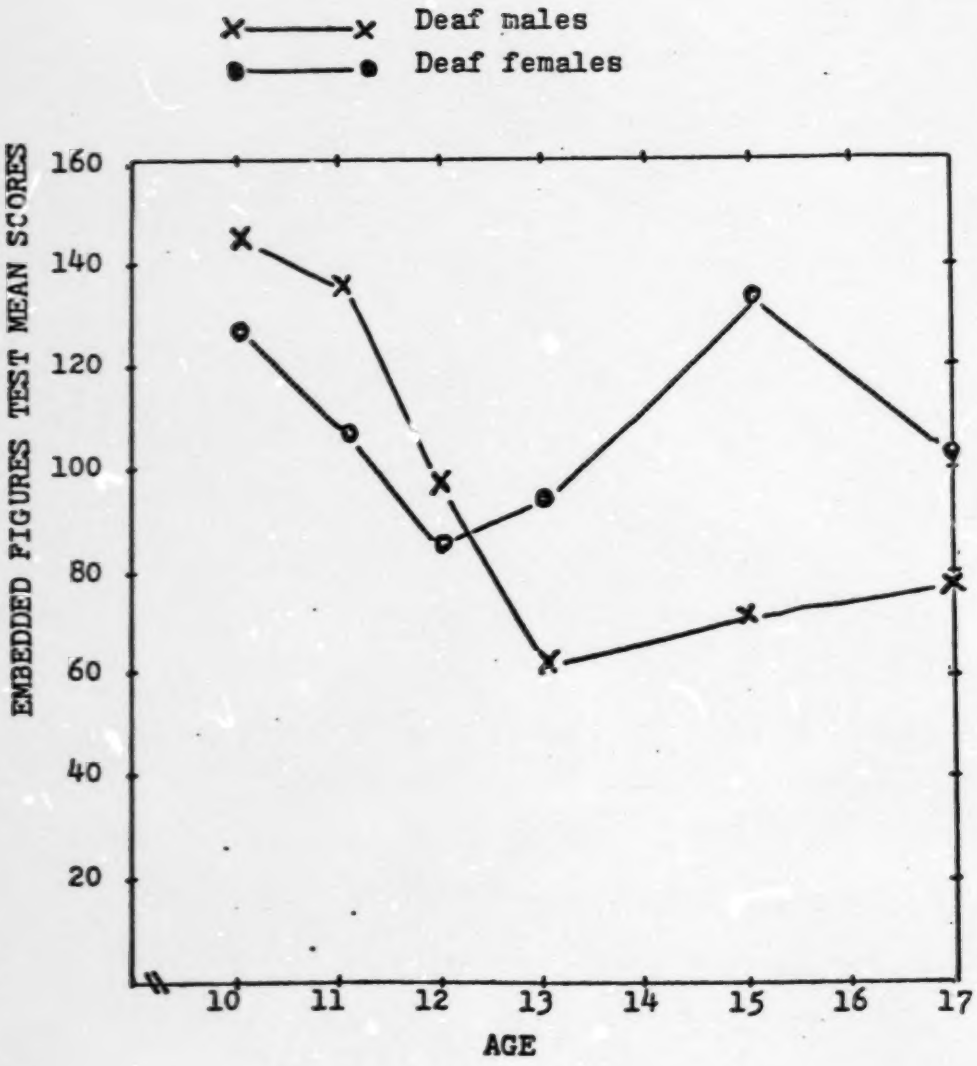
Age and Sex. The results of the analyses on the major hypothesis demonstrated that sex was not a significant predictor of field dependence except at age 15, when males are more field-independent than females. Age is a significant predictor of field dependence for males, with 23 percent of the variance in EFT scores being accounted for by age. Age is not significant for females. A trend toward an interactive effect of sex and age is evident (Figure 1).

Research on Witkin's theory indicates that the sex difference in Western settings does not become regular nor significant until around early adolescence. While this difference is persistent, it is small in magnitude. The range within each sex is vastly greater than the differences in means between the sexes. The mean differences obtained in this study are rarely greater than the deviation within each group. Certainly, the sex differences in field-dependence-independence are not inherent features of the development of differentiation.

Witkin (1979) discusses possible sources of individual differences which may help to clarify the existence of sex differences. Witkin asserts that child-rearing practices, social organization, and the role of ecological factors carry

Figure 1

Mean Scores for Embedded Figures Test by Age and Sex



with them congruent consequences in extent of differentiation. Encouragement within the family of separate, autonomous functioning in the growing child tends to be associated with field-dependence. Witkin stresses that any "emphasis on uniform adherence to predetermined external standards during growth, and continuous reinforcement of such an orientation, are likely to work against the development of a self that is differentiated from other persons" (1979, 367).

Vaught (1965) suggests that the within-sex variance found in measures of field dependence is a function of those personality variables subsumed under the concept of sex-role identification. With regard to within-sex variance, therefore, individuals with more masculine role-identities are more field-independent than individuals with less masculine role-identities. Hulfish (1978) found that sex-role identification in hearing subjects is related to field-dependence-independence in a manner that cuts across biological sex to some extent, suggesting that the basis for the observed sex differences in perceptual style lies in part in socialization procedures and not entirely in biological factors.

Recent studies of field dependence examine the extent to which cross-sex typing is associated with the development of field-independence in young children. Kagan and Kogan (1970) found that cross-sex typing is associated with field-independence in hearing females. Coates (1975) accepts this finding and goes beyond it to endorse Sherman's (1967) causal hypothesis that the extent of practice in tasks of spatial visualization actually influences resultant levels of field-independence. Coates relates several studies which show an overall sex difference favoring females during the years of 3 to 5. At the age of 5, the mean difference is statistically significant.

The results of this study reflect a similar pattern of sex difference favoring females, but at much later ages (10, 11, and 12). At those ages, deaf females in this study tended to be more field-independent than the males. As mentioned

previously, however, the mean differences between the sexes is negligible compared to the variation within the sex groups.

Kohlberg (1966) in a study with hearing children, found that cross-sex interests (associated with field-independence) of girls first increases during the preschool period and then decreases. For boys, same-sex interests and preferences increased during the same period. A similar pattern of results is found in the present study with deaf children, but again at much later age periods; the females initially tend to be more field-independent than the males but then decrease in field-independence. This pattern reflects the pattern of results found by Kohlberg.

Partial support is also given by Fiebert (1967) who administered the CEFT to deaf subjects, ages 12, 15, and 18, and found that males exhibited a direct positive increment with age; females exhibited a curvilinear relationship, with their highest scores being at age 15. The present study also found a rather direct relationship for males and a curvilinear relationship for females. A major difference, however, is that in this study, females at age 15 recorded their most field-dependent scores.

In the previous research, significant sex differences are reported, favoring males in children and adolescents (Blanton & Nunnally, 1964), adolescents (Best, 1975; Fiebert, 1967), college students (Parasnis & Long, 1979), and adults (Naiman, 1969). On all the various measures of field dependence (RFT, CEFT, GEFT, and Gottschaldt Figures) consistent sex differences emerge and indicate that females uniformly are more field-dependent than males.

The results of this study are, in part, contradictory to this previous research since the only significant difference favoring males occurs at age 15. The finding that females in our sample tend to be more field-independent through the age range of 10 to 13 is not supported in the literature. Blanton and Nunnally's

study grouped all ages together, and does not sort out finer differences in performance. Only Fiebert's study indicates a crossover in CEFT performance ability at age 15, when females demonstrate their highest field-independent ability, the mean for females being slightly but not significantly higher than the mean for males. This pattern is not evident in the RFT scores reported by Fiebert. Fiebert's findings with the CEFT conflict with those of this study on which females and males are significantly different at age 15, with females achieving their most field-dependent score. This disadvantage exists in comparing this study to Fiebert's because of his use of the CEFT with subjects in the age range of 12 to 18, when the CEFT is normed for 5 to 12 years of age.

In conclusion, the deaf subjects in this study showed a different pattern of development of field-independence than the hearing norm group (Table 3). In relationship to Witkin's theory of differentiation, a question is raised as to the source of this difference. Since the patterns illustrated (Figure 2) at earlier ages (10 to 13) show no significant differences in extent of differentiation, the age-regressive pattern in evidence during adolescence becomes more perplexing and explanation must be sought outside of the physiological dimension involving the hearing impairment. The psycho-social and cognitive dimensions appear to hold the most promise for further exploration.

Degree of loss and age-at-onset. The results of this study indicate that there is no significant relationship between age-at-onset of hearing loss and field dependence nor between degree of hearing loss and field dependence for the ranges tested. Parasnis and Long (1979) found that degree of loss, measured in decibels (dB), was the second best predictor of GEFT for males only. The correlation of dB loss with GEFT in their study was $r = -.14$.

Parasnis and Long's subjects had a mean dB loss of 90.36 (S.D. = 16.81). The subjects in this study had a mean loss of 102.38 dB (S.D. = 10.40). The subjects

Table 3

Embedded Figures Test Mean Scores:
Comparison of Sample to Norm Group Data[a]

Group		Means and Standard Deviations					
		Sample		N	Norm		N
Ages:							
10	males	144.0	(28.41)[b]	6	117.9	(32.9)	51
	females	125.1	(46.34)	6	126.9	(30.1)	52
11	males*	135.9	(56.34)	4	93.3	(30.1)	21
	females	104.9	(16.16)	5	111.8	(31.6)	24
12	males	97.3	(52.58)	4	94.8	(35.6)	25
	females	81.2	(00.00)	1	105.1	(30.8)	25
13	males	61.9	(28.40)	2	59.3	(23.8)	26
	females	93.8	(69.66)	3	73.4	(37.9)	25
15	males*	71.3	(35.47)	5	34.6	(30.5)	25
	females*	129.8	(43.19)	11	47.1	(22.8)	25
17	males*	77.7	(45.28)	18	32.0	(25.7)	23
	females*	101.0	(40.99)	17	50.4	(26.9)	25

[a] Norm group data from Witkin, et al., 1971.

[b] Numbers in parentheses indicate the standard deviations.

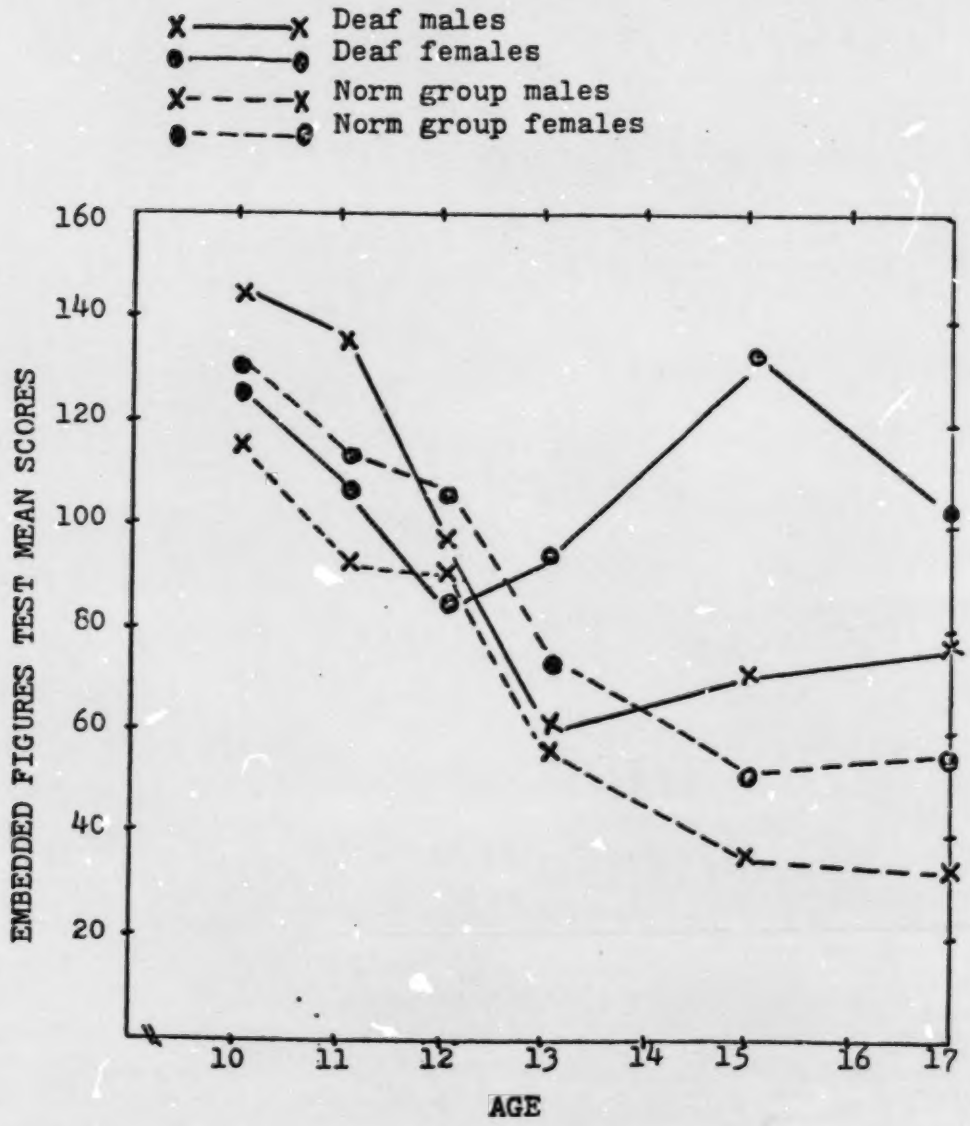
* $p < .05$.

in this study have a greater average loss and narrower range of loss. Both of these aspects--greater degree of loss and a more confined range of loss--influence the probability of detecting a systematic relationship between these variables and EFT performance. This sample is very homogeneous with respect to the variable being used a predictor. The adequate testing of deaf subjects would require a more heterogeneous sample which includes subjects in the range of moderate and moderately severe loss in addition to the severe loss and profound loss ranges found in residential school students. This requirement is essential if significant correlations are to be found for degree of loss as a predictor variable.

Figure 2

Mean Scores for Embedded Figures Test:

Comparison of Sample to Norm Group Data



Age-at-onset is not discussed as a variable in any of the previous studies and is addressed only as a descriptor of the samples. In the present study, the age-at-onset is measured in months. The majority of subjects were deaf at birth (78 percent) and the resultant mean age is 4.4 months. Age-at-onset is negligibly correlated with dB loss (-.19) and EFT performance (-.10). Neither correlation is significant. Once again, the lack of variability in the sample may be the primary factor in the lack of a significant relationship.

Witkin's theory of differentiation would lead to the hypothesis that later onset of the hearing loss would allow for greater development of language and cognitive abilities, since the child would be exposed to normal communication patterns during a critical developmental period. The theory also would support belief that the greater the hearing loss, the less chance of a normal development in extent of differentiation because of the lack of integration of auditory input.

Freedman, however, proposes that "lack of speech and hearing is by no means incompatible with the process of differentiation of psychic structure" (1972, 66). Indeed, with the degree of loss as severe as that found in the subjects of this study, the comparison to hearing norms shows that in several instances, the deaf subjects performed as well as or better on the EFT than did their hearing counterparts. The evidence may be that the sensory deficit is not the complicating factor in development of differentiation. Other factors which are side effects of the hearing loss, rather than the loss itself, might hinder the development of field-independence.

The results of this analysis of degree of loss and age-at-onset confirm the findings of the previous section which indicate similar developmental patterns at ages 10 through 13 for deaf and hearing subjects. If the hearing impairment itself affected the development of differentiation, certainly its influence would be noticeable before the age of 15.

Verbal ability variables. The results of this study indicate that verbal ability as measured by the CAT Reading and Language subtests is a good predictor of field-independence, if age and IQ are controlled.

In a study by Fiebert (1967), girls (ages 12-15-18) showed a positive but nonsignificant correlation (r = .28) to the Paragraph Meaning subtest of the Stanford Achievement Test (1954). In this present study, when sex differences were taken into account, and IQ controlled, Reading was significant for females and language was significant for males as predictors of field-independence. Fiebert also controlled for age. When age was added in the present study, Reading was still a significant predictor variable for females only (Tables 4a and 4b). This finding supports Fiebert's results for females and also supports Parasnis and Long's findings with the SRT.

Table 4a

Multiple Regression Analysis Results for Males[a]: Age, IQ and Reading/Language Subtests as Predictors

Variables	r^2	r	F	d.f.	Percent additional variance
Age + IQ + Reading	.62	.79	13.07**	3,24	--
Age			.02	1,26	.07
IQ			40.53**	1,25	61.81
Reading			.10	1,24	.16
Age + IQ + Language	.65	.81	14.74**	3,24	--
Age			.02	1,26	.07
IQ			40.53**	1,25	61.81
Language			2.02	1,24	2.96

[a] n = 28. * p <.05. ** p <.0001.

Table 4b

Multiple Regression Analysis Results for Females[a]: Age, IQ and Reading/Language Subtests as Predictors

Variables	r^2	r	F	d.f.	Percent additional variance
Age + IQ + Reading	.69	.83	24.27**	3,32	--
Age			.59	1,34	1.69
IQ			54.54**	1,33	61.24
Reading			6.84*	1,32	6.53
Age + IQ + Language	.67	.82	21.35**	3,32	--
Age			.59	1,34	1.69
IQ			54.54**	1,33	61.24
Language			3.59	1,32	3.74

[a] $n = 36$. * $p < .05$. ** $p < .0001$.

Parasnis and Long (1979) used the GEFT with deaf college students and found a high correlation with the Simultaneous Reception Test (SRT) for females only. The SRT is not an English skills test, but a sign skills test that may rely with the EFT on a common cognitive structuring ability.

Two interesting points are made by this study and are hinted at in previous studies. First, Reading remains a significant predictor of field dependence after IQ and age are removed as influences. Second, this relationship holds for deaf females only. For hearing students, field dependence is not significantly correlated with verbal ability for either sex (Witkin, et al., 1962).

Are the basic strategies for Reading related to abilities to disembed on the EFT? Are the structural constraints of language which cause a problem for deaf individual in learning to read related to the ability to disembed? During the national standardization of the 1973 Stanford Achievement Test for the hearing-impaired, the mean reading score of half of the deaf students at age 20 indicates that they read at less than a mid-fourth grade level. At best, only 10 percent of

the hearing-impaired 18-year-olds nationally can read at or above an eighth grade level (Trybus & Karchmer, 1977).

The ability to read appears to involve an irregular process of searching, expecting, and integrating. Studies of linguistic ambiguity have indicated that disambiguation and EFT performance involve similar abilities; that is, restructuring in deep linguistic processing is related to restructuring in the visual-perceptual domain. This relationship between basic reading skills and language development and cognitive processing may be reflected in the remaining significance for females of Reading as a predictor variable.

But why does this relationship hold for females alone and not for all deaf individuals who obviously struggle with the same strategies and constraints in learning to read? For deaf males in our study, the influence of Reading is taken away by age and IQ. For females, the influence of Reading is not removed by age and IQ. Reading ability for females must not be completely reflected in the IQ scores, because Reading is influential even after IQ is considered.

The mean Reading score for females in this sample is slightly higher than the mean Reading score for males. This finding is reflective of national data on Reading Achievement levels which indicate that females score slightly higher than males (Trybus & Karchmer, 1977). Is this slightly higher achievement in Reading for females reflected somehow in the significance of Reading as a predictor of their EFT performance? How is it that females obtain better Reading scores, on the average, than males yet receive the more field-dependent pattern of EFT scores? The nonlinear, non-age-dependent pattern of EFT scores for females makes interpretation of the Reading results perplexing.

Hearing impairment manifests itself in retardation of language skill acquisition and in poor English language ability. The performance of the subjects in this study on the CAT Reading and Language subtests follows the national trend and

indicates linguistic deficiencies. The high correlation of the Reading and Language subtests with the EFT indicates that there is common variance for the deaf in those two types of performance. Deficiency in English language ability does not actually hinder performance on EFT, however, since for females in our sample, EFT scores were above the norm group means for ages 10, 11, and 12. The conclusion is that linguistic deficiencies themselves for the subjects in this sample do not retard development of field-independence.

Conclusion

This study utilized Witkin's theory of differentiation and field-dependence-independence as a reflection of psychological development. The results of this investigation demonstrate that the differences in the developmental pattern of differentiation for a deaf person are not attributable to the relatively fixed and unchangeable factors of degree of loss or age-at-onset. The comparison of EFT performance of deaf subjects to the hearing norm group also indicates that up to age 13, deaf and hearing individuals have rather similar field-dependence-independence patterns. Only at adolescence do sex differences become significant and deaf subjects significantly vary from the hearing norm group. Factors other than the hearing loss itself are apparently operative. If the hearing impairment itself does not prevent the beginning of normal development of differentiation, then with appropriate life circumstances, deaf persons potentially may acquire access to both cognitive restructuring skills and interpersonal competencies, whatever their standing on the field-dependence-independence continuum. The results of this investigation encourage the shifting of attention and efforts to communication patterns within the family, attitudinal and cognitive aspects surrounding the disability, and other psycho-social factors which influence the development of differentiation.

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